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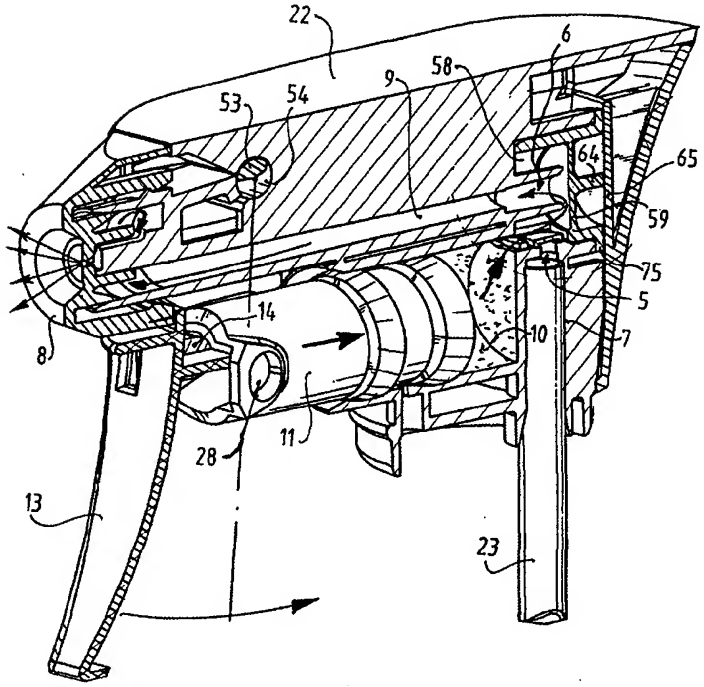
(54) Title: PRECOMPRESSION SYSTEM

(57) Abstract

The invention relates to a precompression system for placing between a pump and a discharge nozzle that are connected by a conduit debouching in a space. The system comprises a precompression valve movable between a closing position and a release position and biased to the closing position by spring means. In accordance with the invention the space is connected to the pump and the conduit is connected to the discharge nozzle. The spring means may be integrated in the precompression valve, for instance as a result of the precompression valve and the spring means being constituted by a resiliently flexible and preferably domed diaphragm. The space may be annular, may surround the end of the conduit and may be bordered by a cylindrical sleeve. The invention further relates to a spraying device comprising a pump, means connected to the suction side of the pump for supplying a fluid, a discharge nozzle connected to the compression side of the pump and a precompression system as disclosed above arranged between the pump and the discharge nozzle. Finally, the invention relates to an assembly constituted by a container and such a spraying device.



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PRECOMPRESSION SYSTEM

The invention relates to a precompression system for placing between a pump and a discharge nozzle that are connected by a conduit debouching in a space, the system comprising a precompression valve movable between a position closing off the connection in which it abuts a seat on the mouth of the conduit and a position releasing the connection in which it is spaced from the seat, the precompression valve being biased to the closing position by spring means. Such a precompression system is known from e.g. the US Patent No. 5,730,335.

The known precompression system is used in a sprayer head for a container, for instance a bottle containing liquid detergent. Such a sprayer head is formed by a body in which a manually operable piston pump is arranged. This pump is operated by a trigger that is pivotally connected to the body. The suction side of the pump is connected to a tube that extends into a bottle over a substantial length, usually nearly to the bottom thereof, and through which liquid may be drawn out of the bottle. The compression side of the pump is connected to the discharge nozzle of the sprayer head through a conduit. Between the pump and the conduit leading to the discharge nozzle is arranged the precompression system, comprising a precompression valve that is kept shut by spring means and that is opened only when a predetermined pressure is attained within the pump. The precompression valve has for its object to prevent the fluid from leaving the discharge nozzle at too low a pressure, which would result in too large drops being formed in the spray. In order to achieve an optimum spraying pattern the liquid must in fact be pressed out of the discharge nozzle at a predetermined and relatively high pressure.

The known precompression system comprises an end part of the cylinder wall of the pump, which

debouches in an annular space. The rim of the cylinder wall constitutes a seat onto which a resiliently flexible diaphragm is pressed. This diaphragm is pressed shut by spring pressure, which in the diaphragm of this older patent is generated by the flexion stresses in the material of the diaphragm itself. When the pressure in the pump cylinder becomes high enough the diaphragm will be lifted from the seat whereby pressurized liquid may flow from the cylinder to the conduit leading to the discharge nozzle. When nearly all liquid has been pressed from the cylinder and the pressure therein drops again, the diaphragm will return to the closing position in which it comes to rest against the seat again as a result of the internal spring force.

The known precompression system has the drawback that the annular space is arranged in-line with the pump cylinder. It is therefore difficult to design this known precompression system such that it can be manufactured by injection molding, and furthermore the resulting design becomes relatively bulky, thus making it hard to incorporate in a compact sprayer head. In the above-mentioned US patent 5,730,335 the pump incorporating the precompression system is arranged under an angle between the suction tube and the spraying tube for manufacturing reasons, which results in a complex structure that is hard to assemble.

The invention therefore has for its object to provide a precompression system of the type described above, which is easier to make and assemble than the conventional precompression system, and which therefore offers a greater freedom of design when integrating it into a compact sprayer head. According to the present invention this is achieved in that the space is connected to the pump and the conduit is connected to the discharge nozzle. By thus reversing the direction of flow in comparison to the known precompression systems, a precompression system is obtained that need not be placed in-line with the pump cylinder, but may for instance be

arranged next to the cylinder. In this way the design of the sprayer head may be substantially simplified, the head may be made more compact and will be simpler and better suited for manufacturing. Furthermore, this has for its result that the cylinder and piston need not be placed under an angle, which is advantageous for the operation thereof.

The spring means are preferably integrated in the precompression valve, for instance in that the precompression valve and the spring means are constituted by a resiliently flexible diaphragm. In this way a structurally simple valve is obtained. The diaphragm is preferably domed, so that it has a stable and suitably tensioned position of rest.

The precompression system preferably includes a stop member cooperating with the diaphragm whereby bending of the diaphragm is limited and the diaphragm is prevented from "flipping over" to another stable position at a greater distance from the seat, from which it would then not return. The stop member is preferably integrally formed with the diaphragm.

Furthermore, the space is preferably at least partially annular and least partially surrounds the end of the conduit, so that a simple circular diaphragm may be employed. The part of the conduit surrounded by the annular space and the pump may each have a centre line, these centre lines being substantially parallel but offset with respect to each other.

The annular space is preferably bordered by a substantially cylindrical sleeve. In this way a proper seal is obtained and leakage may be prevented. The diaphragm and the sleeve may be integrally molded, thereby further reducing the number of parts and thus simplifying assembly of the system.

At least one suction opening closable by a valve is arranged in the sleeve for drawing in the liquid to be sprayed. When the shut-off valve is integrally formed with the sleeve, the number of separate parts is

even further reduced and manufacture and assembly of the precompression system even further simplified.

The invention further relates to a spraying device comprising a pump having a suction side and a compression side, means connected to the suction side of the pump for supplying a fluid to be sprayed, a discharge nozzle connected to the compression side of the pump and a precompression system of the type described above arranged between the pump and the discharge nozzle.

Finally, the invention relates to an assembly constituted by a container and a spraying device as described above.

The invention will now be illustrated by means of an example, with reference being made to the annexed drawings, in which:

Figure 1 is a perspective view of an assembly constituted by a container and a spraying device in which the precompression system of the invention may be used;

Figure 2 is a perspective exploded view of the sprayer head of the assembly of Figure 1 incorporating the precompression system;

Figure 3 is a partly cut away perspective view of the sprayer head of Figure 2 during a pump stroke;

Figure 4 is a view corresponding to Figure 3 of the sprayer head during a return stroke;

Figure 5 is a detailed view of the precompression system in the direction of the arrow V in Figure 3;

Figures 6A and 6B are longitudinal sections through the precompression system at the onset and the end of the pump stroke, respectively, and;

Figure 7 shows a schematic perspective detailed view of an alternative embodiment of a valve used in the precompression system.

A sprayer head 1 for a container 2 comprises a pump 3 having a suction side 5 and a compression side 6. Movable operating means 4 are connected to the pump 3, in the illustrated example constituted by a trigger 13

having a continuous pivot shaft 53 that is received in a hollow space 54 in a frame 22 carrying the pump 3 and that is locked therein by a flexible snap arm 55. Means 7 are connected to the suction side 5 of the pump 3 for supplying a fluid from the container, comprised of a conduit having its free end connected to a tube 23 extending into the container. The compression side 6 of the pump 3 is connected to a discharge nozzle 8 through a conduit 9.

As the shaft 53 of the trigger 13 and the receiving space 54 are located above the spraying conduit 9, an aperture 56 is arranged in the trigger 13, through which extends the end of this conduit 9, onto which is arranged the discharge nozzle 8.

Pump 3 is a piston pump, constituted by a pump housing or cylinder 10 and a piston 11 reciprocating therein. The piston 11 is connected to the trigger 13. In order to return the piston 11 and trigger 13 to their extended position of rest at the end of a pump stroke, the sprayer head 1 comprises biasing means 16. In the illustrated embodiment the biasing means are constituted by a pair of parallel flexion springs 17 that engage ribs at the inside of trigger 13. When the trigger 13 is pivoted around the pivot shaft 53 towards the pump 3 and presses the piston 11 into the cylinder 10 during a pump stroke the springs 17 are bent. When the pressure on the trigger 13 is released it is forced back to its position of rest by the springs 17 flexing back. Since the trigger is connected to the piston 11 such as to remain fixed under both tension and compression, the piston 11 is then also pulled back to its position of rest. The connection between the trigger 13 and the piston 11 is a snap connection formed by protrusions 14 of the trigger 13 being snapped into corresponding openings 28 in the piston 11.

Between the cylinder 10 and the spraying conduit 9 a precompression system is arranged comprising a space 58, which in the illustrated embodiment is

annular, connected to the cylinder 10 and an end part of the spraying conduit 9 debouching therein, which are closed off in a gas- and liquid-tight manner by a resiliently flexible domed diaphragm 59. The space 58 is bordered by a cylindrical sleeve 60 that is received in a cavity 61 in the frame 22 and that is integrally formed with the diaphragm 59 in the illustrated embodiment. In this cylindrical sleeve 60 an opening 15 is formed, in which is arranged a valve, and which is connected to the suction tube 7 for the fluid through an opening 67 in the frame 22. This valve 63, which is also integrally formed with the sleeve 60, is movable, in the shown embodiment pivotable between a position in which it hermetically seals the opening 67 (Figs. 3, 4, 6A) and a position in which this opening 67 is left clear (Fig. 5, 6B). Further a stop member 64 is connected to the diaphragm 59, which serves to limit bending of the diaphragm 59 and to prevent it from "flipping over". The cylindrical sleeve 60 is locked in the cavity 61 of the frame 22 by an end wall which in the shown embodiment is integrally molded with the container 2.

The precompression system 40 serves in known manner to inhibit transport of fluid from the container 2 to the discharge nozzle as long as a predetermined pump pressure is not yet attained. If a fluid is sprayed through the nozzle 8 at too low a pressure, this fluid is insufficiently atomized and drops generated in the spray cone are too large. In order to prevent this from occurring the connection between the container 2 and the discharge nozzle 8 is closed off by the diaphragm 59 which is forcibly pressed against the rim 66 of the spraying conduit 9 serving as a seat due to the internal stress determined by the domed configuration and assisted by the ambient pressure behind the diaphragm 59. Only when sufficient pressure, for instance on the order of 3 bar, is built up in the cylinder 10 by moving the piston 11 to its end position will the diaphragm 59 be lifted from the seat 66.

The sprayer head 1 thus functions as follows. When a user wishes to atomize the fluid from the container 2, he first pulls the trigger 13. In this way air that is present in the cylinder 10 and that cannot flow back to the container 2 due to the opening 67 being shut off by the valve 63 is compressed by the piston 11. When the pressure of the air is high enough at the end of the pump stroke the diaphragm 59 is lifted from the seat 66 and the air may escape.

During the subsequent return stroke forced by the biasing means 16 fluid is drawn from the container 2 through tube 23, conduit 7 and openings 62 and 67 into the cylinder 10 until this is completely filled at the end of the return or suction stroke (Fig. 6A). In order to prevent a partial vacuum from being developed in the container 2 during this stroke an aeration hole 51 is formed in the wall of the cylinder 10, which is opened when an outer peripheral sealing lip 39B passes the opening 51 during inward movement of the piston 11 and which is again connected to a closed space defined between the outer and inner peripheral sealing lips 39B and 39A of the piston 11 during the outward stroke of the piston 11.

When the trigger 13 is then pulled again the pressure within the cylinder 10 will rise very quickly as the fluid is hardly compressible. In this way the diaphragm 59 is lifted from the seat 66 virtually instantly and the fluid may be pressed through the space between the diaphragm 59 and the seat 66 to the spraying conduit 9 and thence to the discharge nozzle 8 (Fig. 6B) where it is atomized.

Since in accordance with the present invention the annular space 58 is connected to the pump cylinder 10 and the conduit 9 debouching therein is connected to the discharge nozzle, instead of the other way around as in conventional precompression systems, the annular space 58 need not be aligned with the cylinder 10, but may be offset as illustrated. The sprayer head may thus be

efficiently manufactured by injection molding so that the design may be kept compact.

Although the invention has been illustrated above on the basis of an embodiment thereof, it will be apparent that it is not limited thereto. The diaphragm and sleeve could for instance be formed separately. Also the stop member might possibly be obviated in some cases, while the choice of materials may of course be varied as well. The scope of the invention is thus defined solely by the appended claims.

CLAIMS

1. Precompression system for placing between a pump and a discharge nozzle that are connected by a conduit debouching in a space, the system comprising a precompression valve movable between a position closing off the connection in which it abuts a seat on the mouth of the conduit and a position releasing the connection in which it is spaced from the seat, the precompression valve being biased to the closing position by spring means, wherein the space is connected to the pump and the conduit is connected to the discharge nozzle.

2. Precompression system according to claim 1, wherein the spring means are integrated in the precompression valve.

3. Precompression system according to claim 2, wherein the precompression valve and the spring means are constituted by a resiliently flexible diaphragm.

4. Precompression system according to claim 3, wherein the diaphragm is domed.

5. Precompression system according to claim 3 or 4, characterized by a stop member cooperating with the diaphragm. 6. Precompression system according to claim 5, the stop member is integrally formed with the diaphragm.

7. Precompression system according to any one of the preceding claims, wherein the space is at least partially annular and least partially surrounds the end of the conduit.

8. Precompression system according to claim 7, **characterized in that** the part of the conduit surrounded by the annular space and the pump each have a centre line, the centre lines being substantially parallel but offset with respect to each other.

9. Precompression system according to claim 8, wherein the annular space is bordered by a substantially cylindrical sleeve.

10. Precompression system according to claim 9, wherein the diaphragm and the sleeve are integrally molded.

11. Precompression system according to claim 9 or 10, wherein at least one suction opening closable by a valve is arranged in the sleeve.

12. Precompression system according to claim 11, wherein the shut-off valve is integrally formed with the sleeve.

13. Spraying device comprising a pump having a suction side and a compression side, means connected to the suction side of the pump for supplying a fluid to be sprayed, a discharge nozzle connected to the compression side of the pump and a precompression system according to any one of the preceding claims arranged between the pump and the discharge nozzle.

14. Assembly constituted by a container and a spraying device according to claim 13.

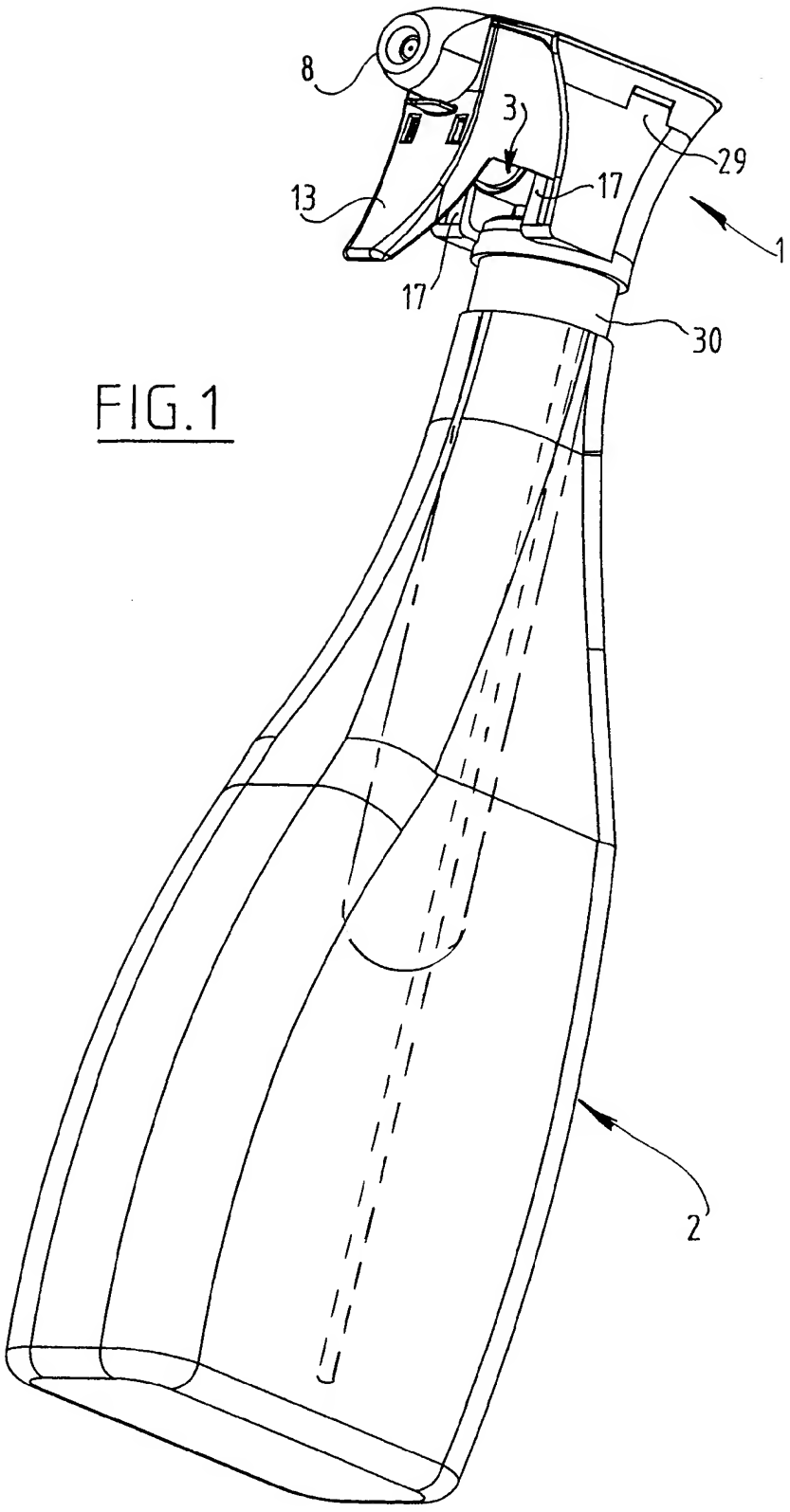

FIG.1

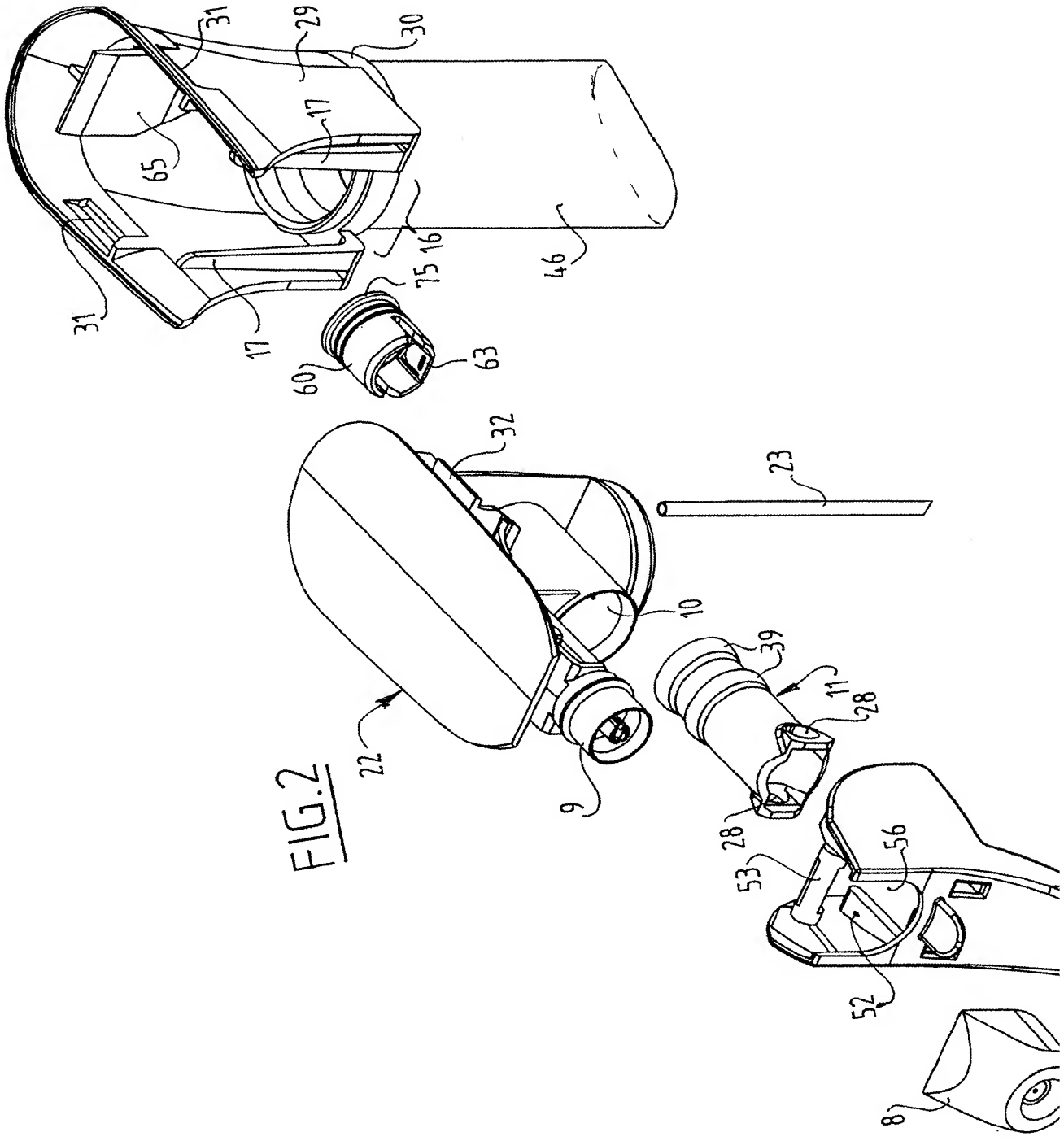

FIG.2

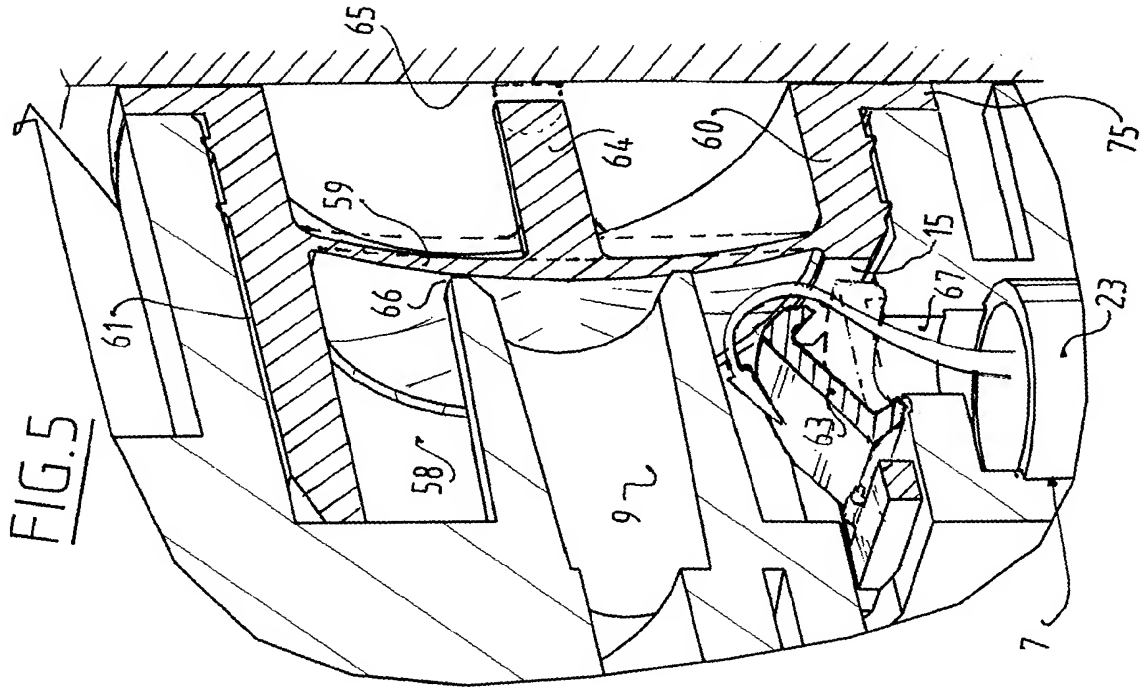
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FIG.5

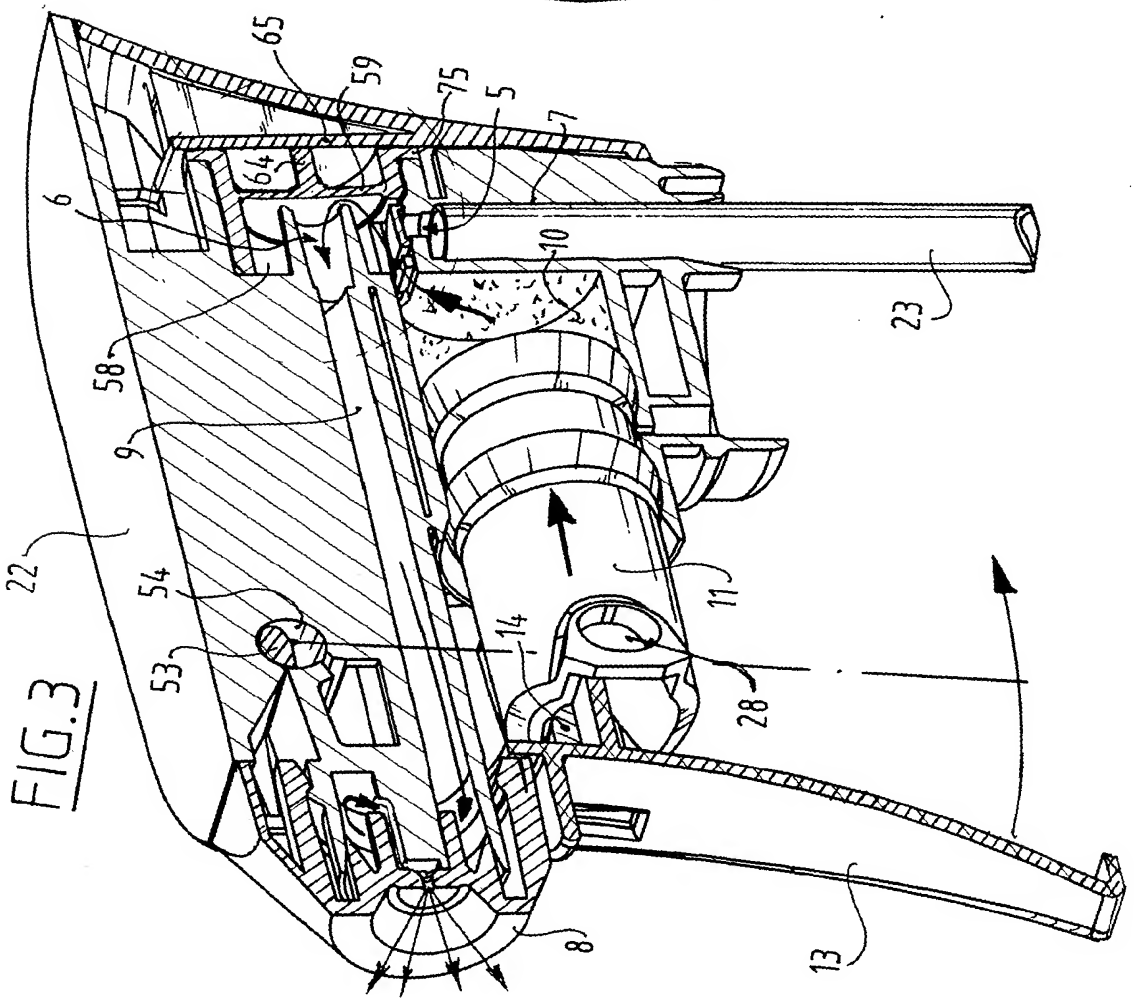
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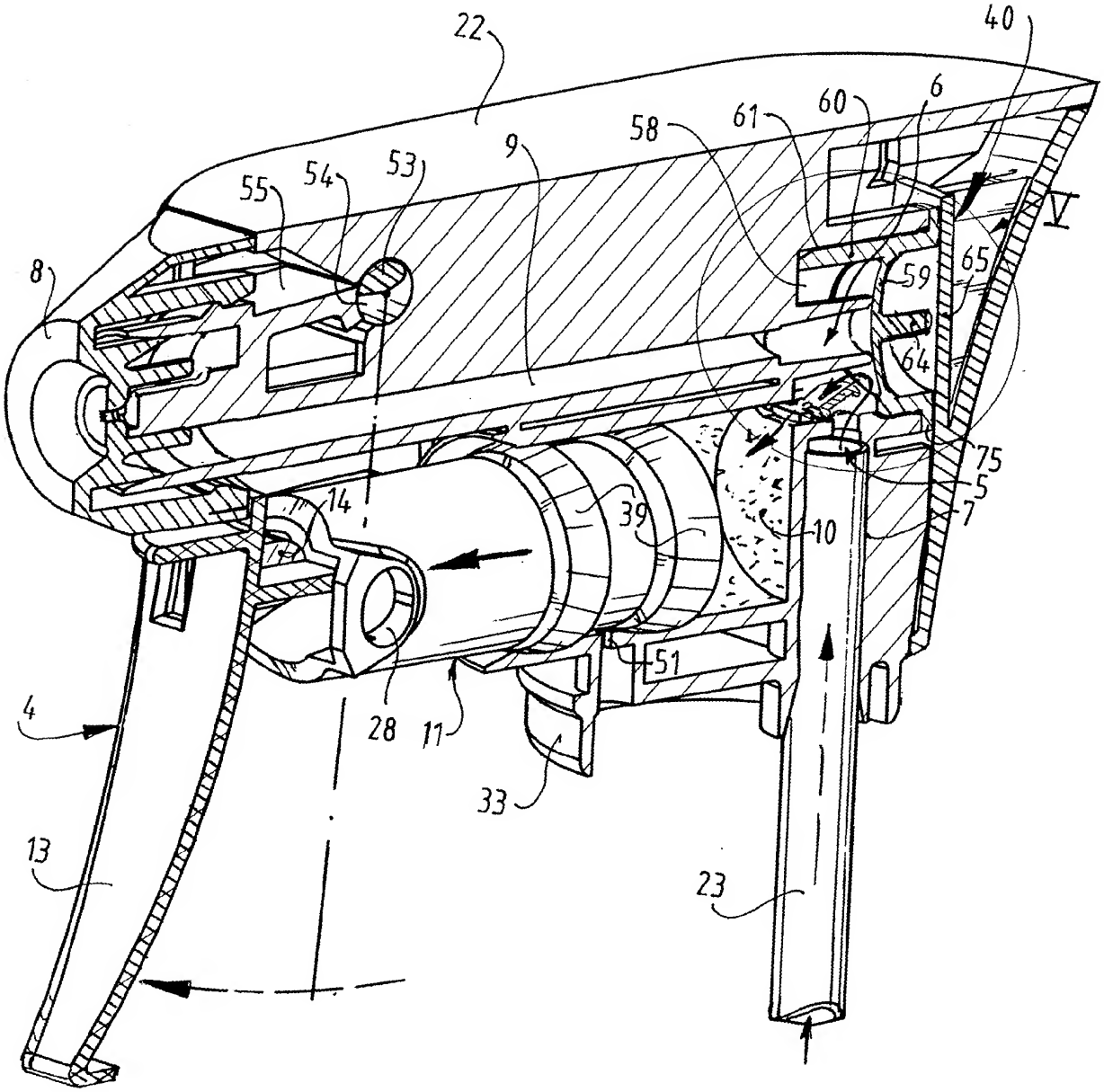
FIG.3

FIG.4



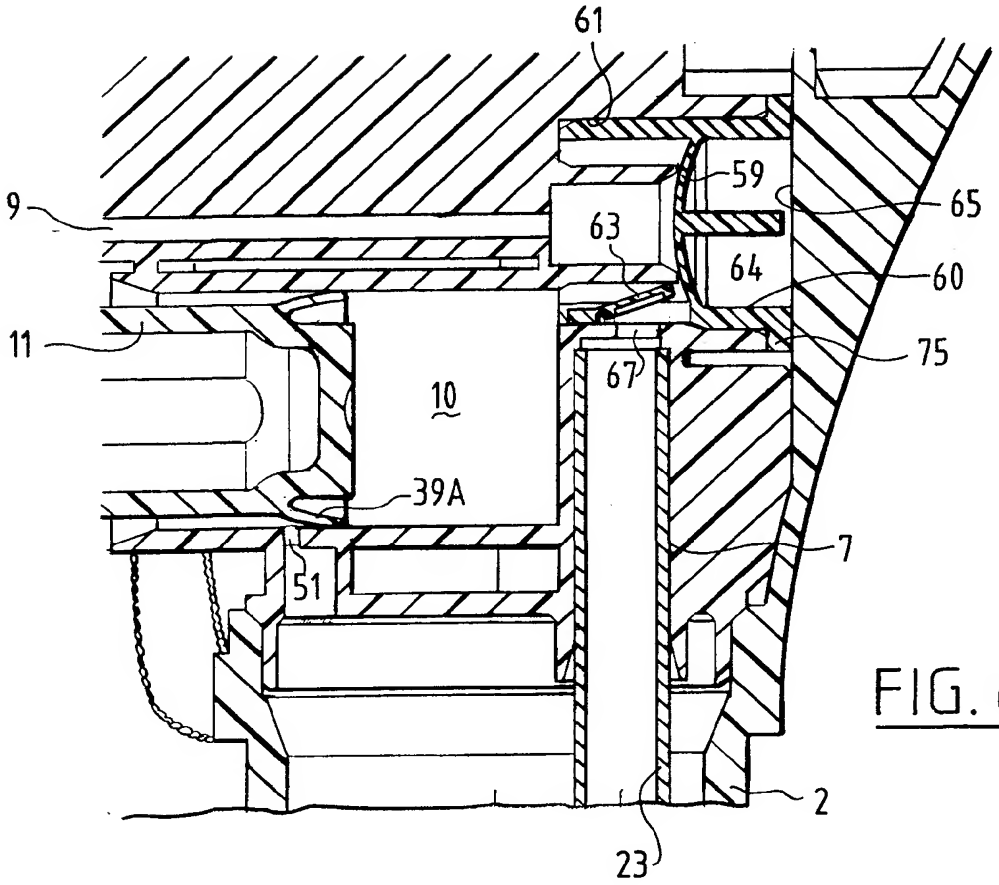

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FIG. 6A

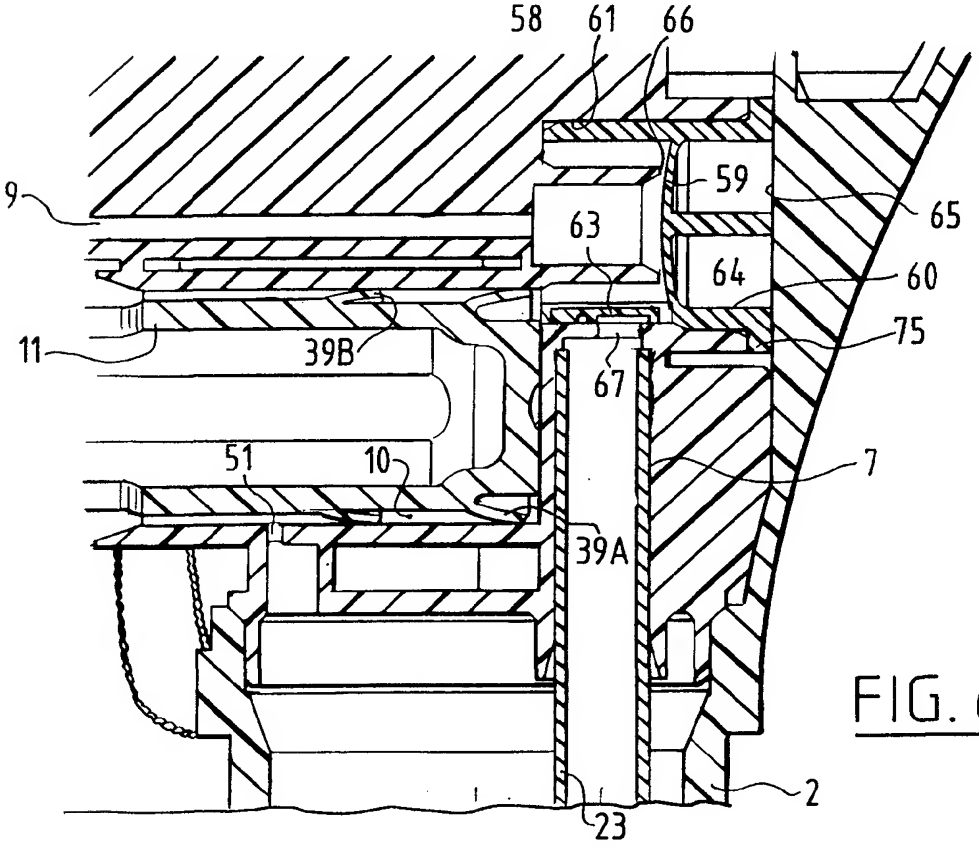
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FIG. 6B

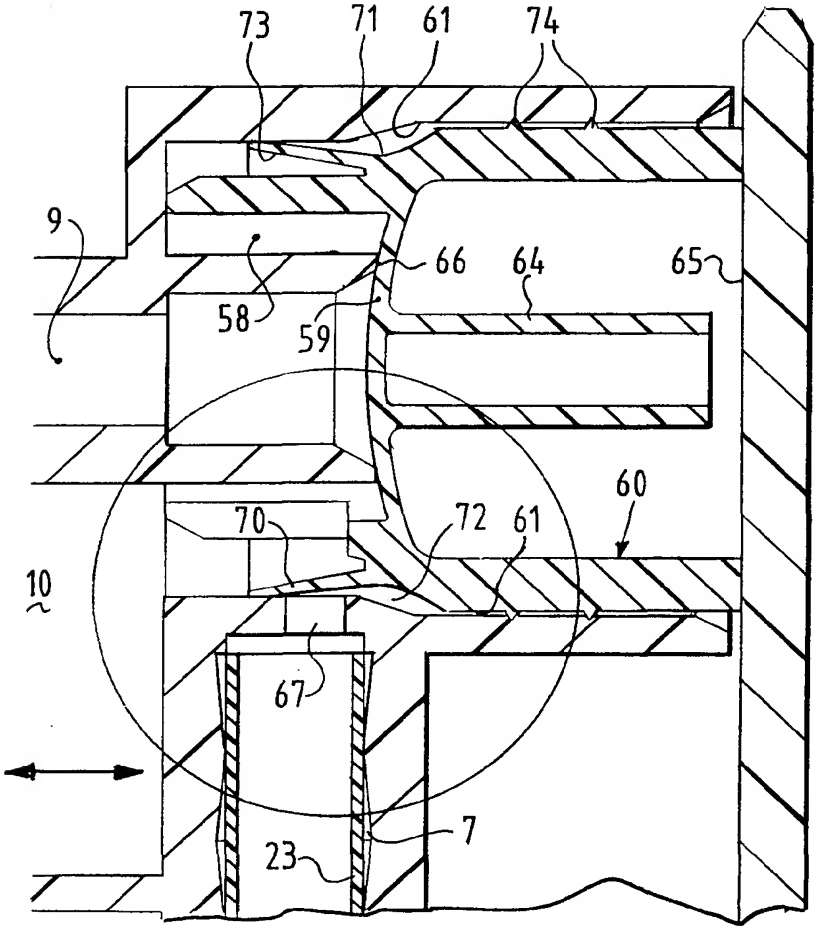

FIG. 8

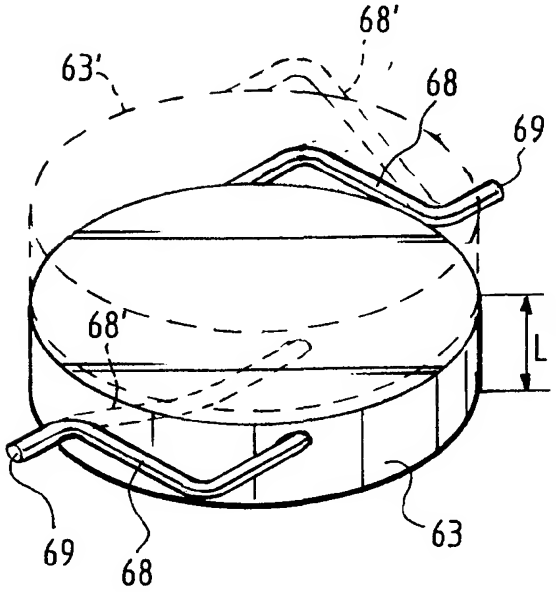

FIG. 7

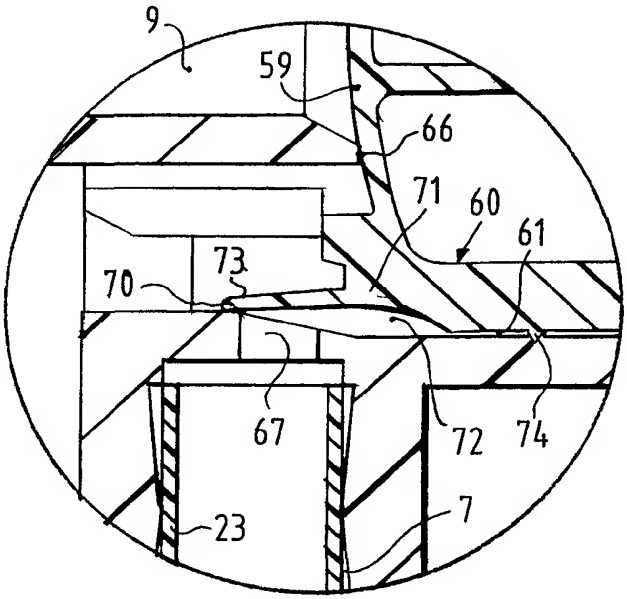

FIG. 9

INTERNATIONAL SEARCH REPORT

Inte ional Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B05B11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 April 2000	02/05/2000

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INTERNATIONAL SEARCH REPORT

Int .onal Application No
PCT/NL 99/00761

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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3

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte onal Application No
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